AbstractID: 9398 Title: Integration and Verification of 3T Magnetic Resonance Spectroscopic Imaging in Radiation Therapy Treatment Planning

Purpose: The purpose of this work is to test the feasibility of MRSI integration into brain tumor RT planning using a custom-built MRSI head phantom as well as a case study.

Method and Materials: A special MRSI head phantom was constructed with spatially well-defined tube inserts. Each tube contains different pre-determined concentrations of metabolite solutions that mimic different degrees of brain tumor burden and were immersed in a background solution that emulate normal brain metabolite levels. The 3D MRSI data were acquired on a Siemens 3T TRIO TIM scanner using PRESS (point resolved spectroscopy) sequence with TE/TR: 135/1510 ms, 16x16x 8 matrix, FOV: 16x16x8 resulting in MRSI voxel size of 10x10x10 mm^3. Registration of MRSI (gray scale DICOM) data with planning CT and creation of metabolite-derived target contours were performed on Pinnacle treatment planning system. Target contours created using MRSI-derived tumor metabolic abnormalities were compared with those created based on morphological (T2 and T1 contrast weighted) MRI scans.

Results: The CT-MR (T1) registration accuracy was found to be within 1 mm, with no spatial distortion during MRSI. Registration errors were found in the TPS due to field-of-view size and origin difference between studies. These were corrected using a simple algorithm to determine the translation. Re-scaled MRSI pixel values allowed automated segmentation of metabolic ratios and were consistent with those identified on the control console of the MRI scanner. When applied to a clinical case, a 42 cc (or 58%) reduction in the treated volume of the PTV was possible, assuming the CNI ratio of 2.5 included all microscopic extension of disease requiring the boost dose.

Conclusion: MRSI derived functional information can be incorporated into RT planning for brain tumors well within the registration tolerance limits of current planning process.

Conflict of Interest (only if applicable): None.